

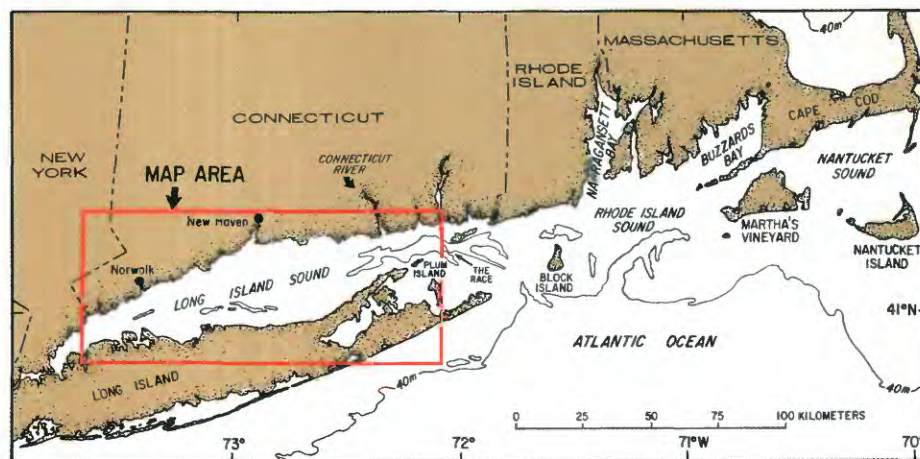
# Sedimentary Environments in Long Island Sound: A Guide to Sea-Floor Management in a Large Urbanized Estuary

*"Bottom sedimentary environments, defined by sidescan-sonar patterns, indicate where sea-floor sediments are moved and deposited in the Long Island Sound estuary. The patchy distribution of environments, which reflects both regional and local changes in geologic and oceanographic conditions, provides a predictive framework for those concerned with the management and utilization of the sea floor in this urbanized area."*

Harley J. Knebel  
U.S. Geological Survey

## The sea floor in Long Island Sound serves many uses.

Long Island Sound is a major coastal estuary near the most densely populated region of the United States. It abuts the New York-Connecticut metropolitan area (fig. 1), and more than 8 million people live within its watershed. As a consequence of this enormous population, the sound is heavily used, and, thus, the sea floor can be affected by human activities. The sea floor comprises a variety of benthic habitats that support a large commercial and recreational fishery. It can also be a sink for wastes and



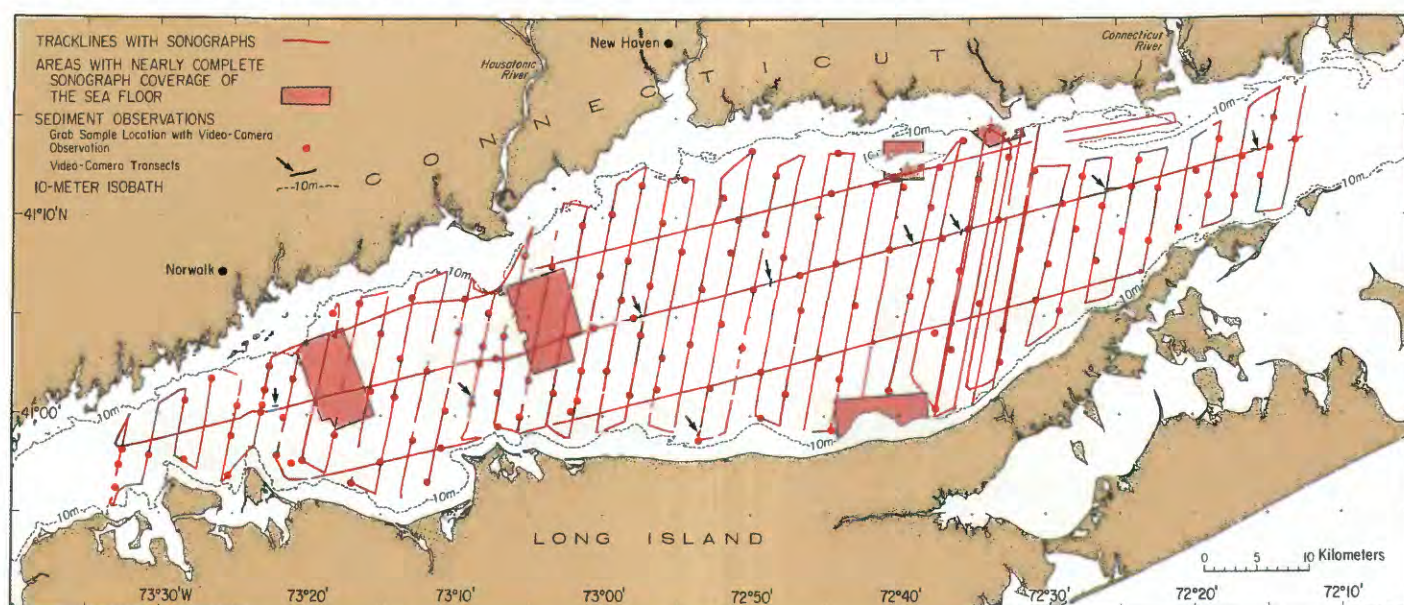
**Figure 1.** Location of the Long Island Sound estuary. The outlined map area is presented in figures 2 and 4. Contours show water depths of 40 meters (131 feet).

contaminants derived from sources such as wastewater treatment plants, urban runoff, riverine input, and airborne transport (Wolfe and others, 1991, *Estuaries*, v. 14, p. 224-236).

## Bottom sedimentary environments provide a framework for assessment and prediction.

Bottom sedimentary environments not only indicate ambient sea-floor processes at

particular locations, but they also reveal spatial changes in geologic and oceanographic conditions across the basin. These aspects provide a framework for understanding the attributes of the present sea floor and for predicting the effects of future alterations. A primary goal of U.S. Geological Survey (USGS) studies in Long Island Sound has been to define the regional distribution and characteristics of these sedimentary environments.



**Figure 2.** Locations of sidescan sonographs, grab samples, and video-camera observations used to infer the distribution and characteristics of sea-floor sedimentary environments within the Long Island Sound estuary. The 10-meter (33-foot) depth contour delineates the shoreward limit of the study area along the Connecticut and Long Island coasts.



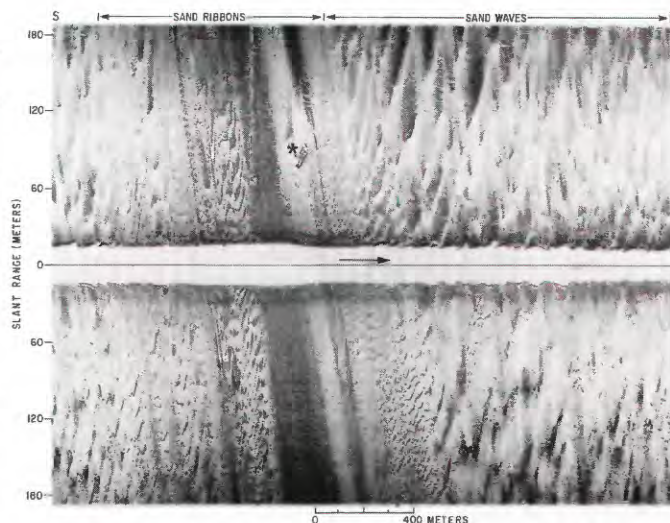
## Sea-floor sedimentary environments can be recognized by characteristic sidescan-sonar patterns.

The USGS, in cooperation with the State of Connecticut Department of Environmental Protection and the U.S. Environmental Protection Agency, collected an extensive set of sidescan sonographs to characterize the sea floor within the Long Island Sound basin (fig. 2). Backscatter patterns in the sonographs (fig. 3) were interpreted with the aid of strategically located sediment samples and video-camera observations, as well as modeled current and wave data. The sonograph patterns define four categories of long-term sedimentary environments: erosion or non-deposition; coarse-grained bedload transport; sediment sorting and reworking; and fine-grained deposition. The distribution of these environments has been mapped across the sound (fig. 4).

### The distribution of sedimentary environments is patchy.

Broad areas of fine-grained deposition are present across the generally wide central and western parts of the sound (fig. 4). Here, deposition results from the accumulation of particle aggregates under relatively weak bottom tidal currents. Locally, however, the fine-grained deposits are discontinuous where bottom currents cause sediment winnowing and bypassing. In contrast, the funnel-shaped eastern part of the sound contains large areas of sediment erosion, transport, and sorting caused by a combination of strong tidal currents and a net westward movement of sediments into

**Figure 3.** Sonograph obtained across the east-central part of Long Island Sound showing an environment of coarse-grained bedload transport depicted by patterns of sand ribbons and sand waves. Such areas contain only small amounts of fine-grained sediments and associated contaminants and may have significant sand resources. A sunken vessel about 18 meters (59 feet) long (marked by asterisk) is present in the sand-ribbon area.



the estuary. Such environments remove most fine-grained detritus and cause selective enrichment of sand and gravel on the sea floor.

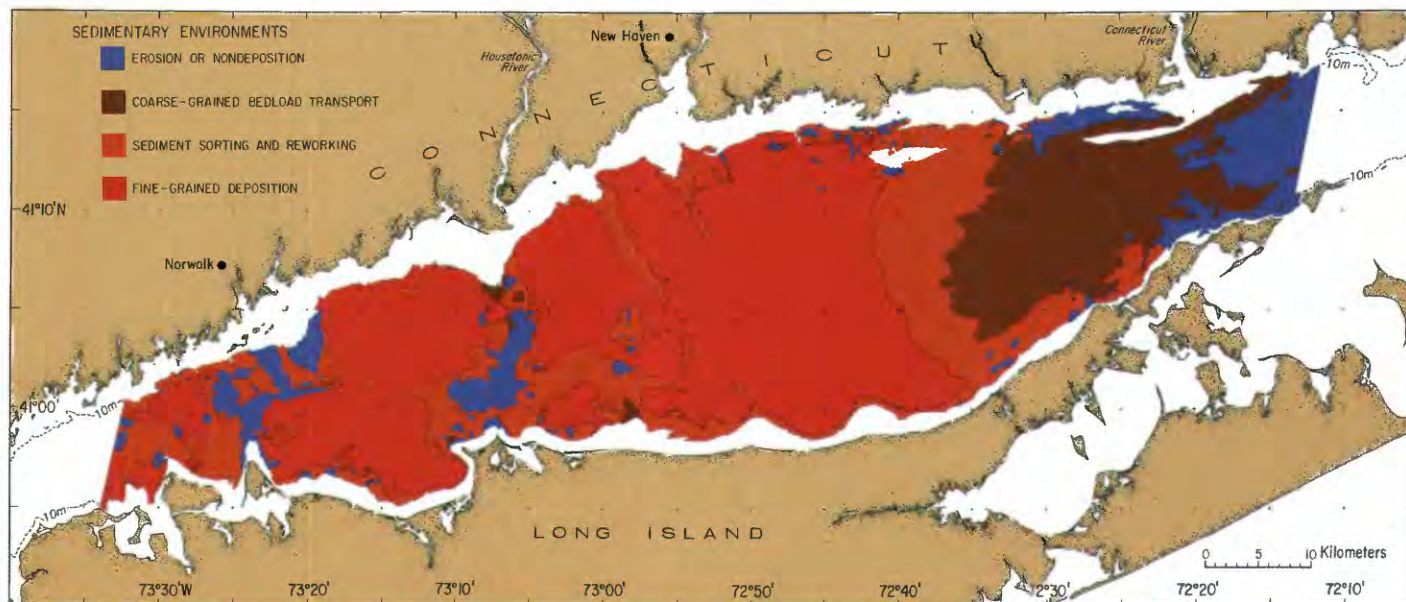
### USGS studies provide essential data for environmental managers.

Environmental managers can use the distribution of bottom sedimentary environments to define the locations and variability of benthic habitats because the distributions of benthic habitats and sedimentary environments are largely controlled by the same geologic and oceanographic conditions, such as sea-floor substrate and bottom-current strength. Likewise, the distribution of environments provides insight into the long-term fate of contaminants that are associated with fine-grained detritus. Managers can use this insight to predict where contaminants will ultimately be transported and deposited or to design

effective monitoring programs to document future anthropogenic changes. Managers also can use the distribution of environments as a guide to the future utilization of the sea floor. Future activities in Long Island Sound might include the emplacement of structures on or within the bottom sediments, the disposal of dredged spoil, or the assessment of sand and gravel resources.

### For more information, please contact:

Harley J. Knebel  
U.S. Geological Survey  
Woods Hole Field Center  
384 Woods Hole Road  
Woods Hole, MA 02543-1598  
Telephone: (508) 457-2269  
Fax: (508) 457-2310  
E-mail: [hknebel@usgs.gov](mailto:hknebel@usgs.gov)



**Figure 4.** Reconnaissance map showing the distribution of sedimentary environments across the Long Island Sound estuary. Sedimentary environments have been inferred from sonograph patterns, sediment samples, video-camera observations, and modeled current and wave data. The 10-meter (33-foot) depth contour delineates the shoreward limit of the study area along the Connecticut and Long Island coasts.